List of Attachments

Attachment 1 - Calkins Study

Technical Report on ALLTEL's Proposal for the Gulf Rulemaking

By James E. Calkins, July 3, 2000

1.0 ALLTEL's Proposal Provides a Fair Solution

ALLTEL's proposal is to create a neutral 12 nautical mile (22.2 km) Coastal Zone without exclusive market rights using the land-based propagation formula contained in section 22.911(a) for both Land-based and Gulf-based carriers (the "Neutral Zone").[1] Land carriers could place an SAB extension into the Coastal Zone up to the 12 nautical mile limit as necessary to provide adequate service to Land-based subscribers. In my judgment, the ALLTEL proposal presents an innovative and technically feasible solution to a problem that otherwise cannot be successfully resolved for both Land and Gulf carriers. Further, neither the current rules nor the various proposals of the Gulf carriers adequately address the legitimate service requirements of Land-based carriers.

In order to serve their subscribers, Land carriers require a significantly stronger signal at the market border (i.e. the shoreline) beyond that either provided by a 32 dBu contour under the Commission's current rules or required by the Gulf carriers to provide service to their subscribers. The need for a stronger signal arises from the fundamental differences between Land-based service and Gulf-based service in the type subscriber equipment, service conditions and propagation environment in which the respective carriers operate. Consequently, it is virtually impossible to develop a practical formula reasonably defining the "real world" service contours of both Land and Gulf carriers in the Coastal Zone. There is no equitable way to make these conflicting requirements match up at the shoreline. ALLTEL's proposal allows for a transition from one environment to another, and will result in both Land and Gulf carriers being able to provide better service to the public.

1.1 Existing Rules Do Not Allow Adequate Service to Land Carriers

[1] ALLTEL notes that the use of the Land-based formula by both Land and Gulf carriers is a significant element of the Joint Petrocom/U.S. Cellular proposal.

The existing 32 dBu Service Area Boundary ("SAB") does not allow adequate service to typical land subscribers at the shoreline in the absence of large SAB extensions into the Gulf (See section 1.1.1 below for example.) This situation is the result of the development of the SAB definition currently contained in the Commission's rules. The Land SAB defined in 22.911(a)(1) is, in effect, the 32 dBu Carey contour.[2] This definition was developed during the Unserved Area proceeding to describe a reasonable expectation of service to a car phone with a permanent antenna in a rural environment, which was a fair scenario in the context of that rulemaking (i.e. the rulemaking to define service to *unserved* area inasmuch as well populated and traveled territory had for the most part been covered at that time). Hence, the current Land SAB definition does not provide for the level of service that must be delivered by land carriers in order to serve hand-held portable phones. In today's environment, virtually all Land subscribers rely on portable phones as opposed to the car mounted mobiles, which served as the basis for the contour definition. This is an important difference, inasmuch as portable phones suffer considerable signal attenuation compared to mobile phones due to the effect of blockage of the antenna by the user's body. Further, they must be usable inside of cars and buildings, which impose substantial signal blockage.

Appendix A set forth the basis for determining adequate signal levels for Land-based service to portables using industry standards and contains a detailed comparison of actual land service requirements to the level of service now afforded under the current land SAB formula. The analysis indicates the need for additional signal strength at the shoreline as follows:

Land Subscriber Type	Additional Signal Level Required
Mobile Car Phone	13.0 dB
Portable Phone on Street	21.6 dB
Portable Phone in Car	28.2 dB
Portable Phone in Building	34.6 dB

Table 1 – Additional Signal Level Required for Reliable Land Service
Excerpt From Appendix A

[2] CC Docket 90-6, Second Report and Order, 7 FCC Rcd 2449 (1992) at paragraph 9.

1.1.1 Propagation Plot of Typical Coastal Site Under Existing Rules

Appendix B, Plot 1 depicts the Gulf Shores site in the Mobile, Alabama MSA B-Block market now owned by ALLTEL, configured under the current rules. Although located over 9 km. from the shoreline, the sectors pointed towards the coast must use the extremely low power of 1 watt ERP and mechanical downtilt to avoid an extension into the GMSA. Using the signal levels developed in Appendix A as the basis for establishing good service to portables, the site provides no usable service to the shoreline and hence disrupts contiguous service to Land-based subscribers.

1.2 A Neutral Zone Using the Land-Based Formula Will Improve Service for Land and Gulf Carriers

Allowing Land carriers to place SAB extensions past the current GMSA limit will allow them adequate signal at the shoreline to support their subscriber service demands. Gulf carriers will benefit by being allowed to increase their signal at the shoreline by up to 23 dB from that currently permitted (subject, of course, to frequency coordination). This will allow Gulf carriers the opportunity to provide service to their subscribers on inland waterways (with subscriber units in "home-only"), and to use platforms which, given the default values currently contained in the rules, are too close to shore to allow useful power outputs. See Table 2 for a comparison of equal SAB distance site configurations for Land and Gulf carriers and minimum SAB distances under the current rules.

	Land ERP (w)	GULF ERP (w)	DELTA ERP (dB)	HAAT	Land SAB (km)	GMSA SAB (km)
A	380	2.6	21.65	30.5	22.2	22.2
B	95	0.65	21.65	61	22.2	22.2
C	42	0.29	21.61	91.4	22.2	22.2
D	24	0.165	21.63	122	22.2	22.2
E	21	0.1	23.22	30.5	13.6	13.6
F	18.5	0.1	22.67	61	16.8	16.8
G	16.3	0.1	22.12	91.4	18.9	18.9
H	15.4	0.1	21.88	122	20.6	20.6
I	0.1		Minimum SAB	30	5.4	
J		0.1	Minimum SAB	8		9.1
Minimum ERP for calculations is the greater of 0.1 or max ERP/500						
HAAT for GMSA is minimum of 8 meters						
HAAT for Land is minimum of 30 meters						
Land SAB uses 22.911(a)(1) formula: $d = 2.531 \times (h^{0.34}) \times (p^{0.17})$						
GMSA SAB uses 22.911(a)(2) formula: $d = 6.895 \times (h^{0.30}) \times (p^{0.15})$						
d is radial distance in kilometers; h is radial antenna HAAT in meters; p is radial ERP in watts						
The Coastal Zone is 12 nautical miles = 13.8 statute miles = 22.2 km						
Delta ERP is the ratio of Land ERP to Gulf ERP expressed in decibels.						

Table 2 – Comparison of Land and GMSA Formulas at Equal Heights and Distances

1.2.1 Propagation Plot of Typical Coastal Site Under Proposed Rules

Appendix B, Plot 2 depicts the Gulf Shores site as it would likely be configured under the proposed rules, with mechanical downtilt removed and ERP increased to 150 watts. The site can provide good coverage (as defined in Appendix A) to portable phones of Land-based subscribers over most of the adjacent shoreline.

1.2.2 Propagation Plots of Potential Gulf Sites Under Proposed Rules

Appendix B, Plot 3 depicts the coverage and SABs of an existing site VK124 operated by Coastel off the Alabama coast near Gulf Shores. ERP at the site has been increased from the current 100 watts to 200 watts by changing antennas to a higher gain to take advantage of the proposed rules. Since the site is about 35 km from shore, it cannot take full advantage of the ALLTEL proposal, yet it still manages to provide usable coverage of inland waters near Mobile Bay.

Appendix B, Plot 5 uses a hypothetical site (Coastel Hypo) based on VK124 but located near the Exclusive Zone Boundary. Although this specific location is not necessarily feasible, it provides a useful example the benefits the proposed rules would provide to similarly situated existing sites or potential future sites not currently feasible.[3] Note that only the coverage shown over water is valid because the propagation model parameters are set for a receive antenna height of 9.1 meters and the predicted signal level reflects Gulf service requirements, not land. Coverage on land would be much reduced.

1.3 Carriers Will Serve Their Own Markets

The Neutral Zone would serve as an area of overlapping service contours from Land and Gulf carriers and will separate the protected markets on land and in the Exclusive Zone of the GMSA sufficiently to ensure that the proper carrier will typically be the best server in their own market.

[3] Under the current rules, a Gulf carrier site located at the proposed distance of 22.2 km with a height of 32.9 m. would be limited to an ERP of 2.2 watts instead of the 200 watts used in the example.

1.3.1 Propagation Plots Showing Most Likely Server Under Proposed Rules

Appendix B, Plots 4 and 6 depict the areas where each of the Coastel sites (as modified above to take advantage of the ALLTEL proposal) would provide the strongest signal. Plot 4 indicates that even the non-optimal existing location of VK124 can adequately protect the Exclusive Zone from excessive subscriber capture (except in the Eastern Gulf where the Gulf carriers do not provide service.) Note that the Land site uses certain Gulf propagation parameters to provide a valid signal ratio calculation (See Appendix B). Plot 6 depicts the same analysis for the Coastel hypothetical site and shows it as most likely server through most of the Neutral Zone.

2.0 Gulf Carrier Solutions are Invalid

Proposals submitted by the Gulf carriers[4] will create additional problems for Land subscribers on the coast by introducing routine subscriber capture by Gulf carriers to the existing problem of inadequate signal strength. Neither co-location, microcells, or "signal balancing" when used with a shoreline market boundary will allow land carriers to adequately serve their markets.

2.1 Inadequate Signal for Land Carriers

Both the Petrocom Comments and the 1998 Gulf Ex Parte propose the same limitations on Land carriers' ability to provide adequate signal to their subscribers as exists under the current rules. Point 2 of the Joint Petrocom/U.S. Cellular proposal to allow higher power when balanced by a higher signal from the Gulf carrier offers little opportunity for a meaningful power increase, inasmuch as land carriers require increases of 13 to 35 dB to provide adequate service (See Table

[4] Joint Comments of Petroleum Communication, Inc. and U.S. Cellular Corporation (Petrocom Comments) filed May 15, 2000 and the Gulf Carrier Ex Parte (Gulf Ex Parte) cited therein.

1, above and Appendix A). Further, this point ignores the current signal superiority to which Land carriers are entitled under the Commission's current rules.

2.2 Subscriber Capture By Gulf Carriers

2.2.1 Use of Land SAB at a Common Boundary Will Result in Capture by Gulf Carrier

The use of the Land SAB formula by both Land and Gulf carriers at the shoreline will result in the Gulf carrier having a higher actual signal level than predicted due to the reduced attenuation path over water. The magnitude of the imbalance would be about 10 dB[5], resulting in guaranteed subscriber capture by the Gulf carrier in the Land carrier's "protected" market. This is particularly problematic for Land carriers along the Gulf given the significant aggregation of subscribers along the beachfront.

2.2.2 Use of Measured Equal Signals at the Shoreline Will Result in Capture by Gulf Carrier

First, equal signal levels result in a 50% likelihood of capture by either carrier. When used at the shoreline, a high number of subscribers are potentially affected, with the majority being Land-based subscribers. Second, the concept of balancing an inland site with a sea-based site is fundamentally flawed because it seeks to balance signal levels at discrete points[6] along a border of disparate propagation environments. While the signal can be balanced at a given point on the shoreline, the area of signal balance up and down the coast from that point must form a hyperbolic curve going inland on the edges due to the higher rate of signal loss encountered by the land transmitter. The method is usable by adjacent terrestrial markets because they have

[5] Y. Okumura, E. Ohmori, T. Kawana, K. Fukuda, "Field Strength and Its Variability in VHF and UHF Land-Mobile Radio Service", ¶4.4, (Review of the Electrical Communication Laboratory, September-October 1968).

similar rates of signal loss through their propagation environments, which tends to produce comparable signal levels up and down the border from the balance point. Such is not the case in the Gulf.

2.2.3 Rebuttal of Gulf Ex Parte Centennial Letter

The endorsement of co-location from Centennial Communications contained in the Gulf Ex Parte Exhibit 6 indicates that under the right circumstances and with careful engineering and equitable business considerations, co-location is feasible. However, as an engineering matter, the conditions in the specific markets of Beaumont-Port Arthur and Louisiana RSA 5 do not fit a general case for the Gulf Coast. The coastline in these markets (shown on the attached Figure 1) is swamp with few inhabitants or recreational areas. The only significant subscriber aggregation on land would be on Highway 82 and Highway 87. The highways are far enough inland so that antenna directivity on a back-to-back site on the beach can produce enough of a signal capture ratio at the highways to prevent significant loss of revenue by the Land carrier. Further, without an SAB extension from the Gulf carrier, the land carrier would not have been able to provide coverage of these major roads due to their proximity to the shoreline. In other areas of the Gulf, the coastline frequently has a high aggregation of residential and recreational population, resulting in the likelihood of a large degree of capture by the Gulf carrier.

[6] The Petrocom/U.S. Cellular joint proposal requires line of site for all sample points and it is therefore not reflective of the propagation environment in which signals are to be balanced.

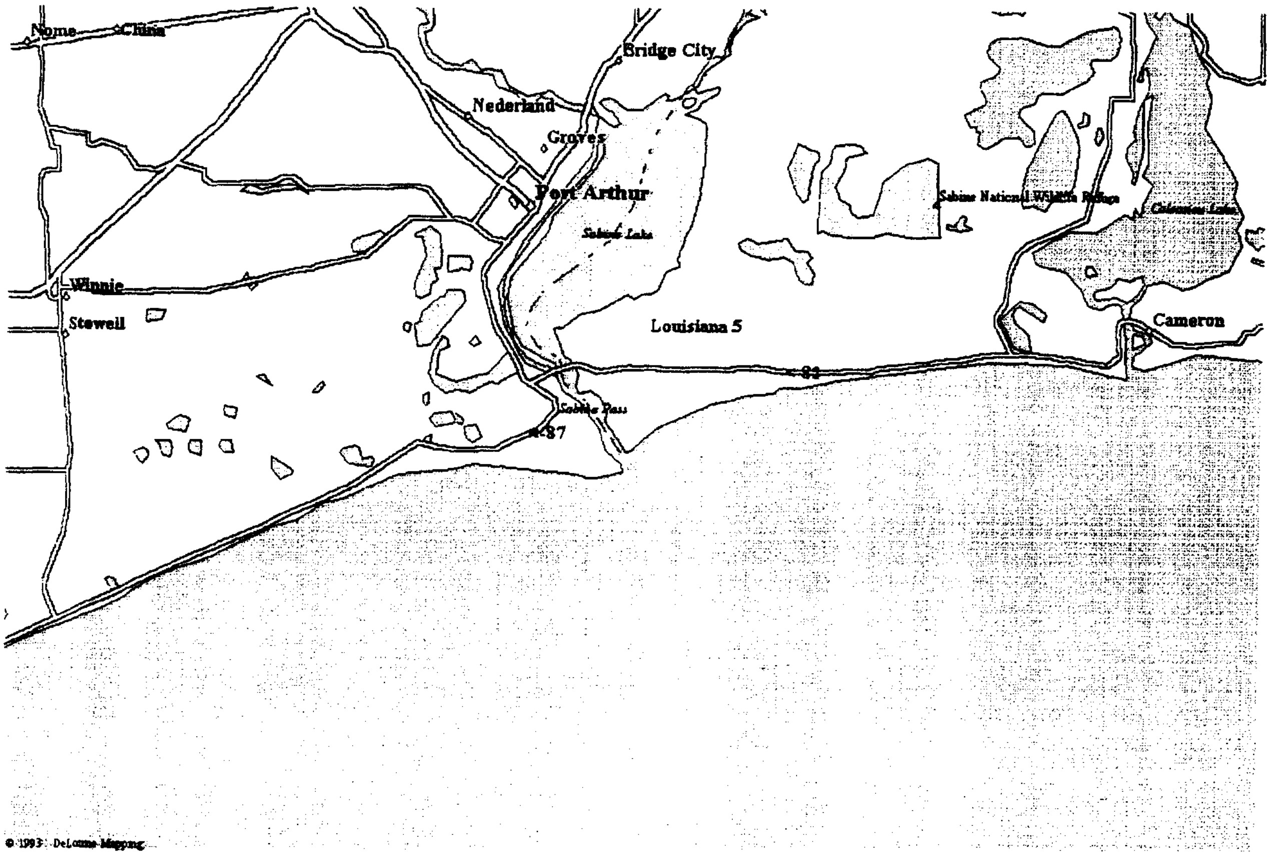

Figure 1 – Beaumont-Port Arthur and Louisiana 5 Coastline

2.3 Microcells Are Not a Solution

Microcells have been proposed as a way for Land carriers to provide adequate service under the current rules. However, the rules only address microcells in the context of unserved area filings in 47 CFR § 22.911(3). Even in this narrow, case the minimum SAB is still defined as 5.4 km by 47 CFR § 22.911(5). The maximum power permitted is only 10 watts at 10 meters height. As heights are lowered below 30 m., local obstructions on land quickly block line-of sight paths and greatly reduce the coverage area.[7] Typical microcells have coverage areas of 0.5 to 2.0 km.

[7] S. Faruque, Cellular Mobile Systems Engineering, p. 144-149, Artech House 1996.

Even assuming the rules were changed to better reflect microcell performance, the cost of implementing microcells over a long coastline would be exorbitant.

3.0 Summary

In the context of a non-exclusive Neutral Zone as proposed by ALLTEL, the best formula for SAB determination is the land formula for both Land and Gulf carrier stations, both in the Coastal Zone and the Exclusive Zone. The fact that the formula is a poor predictor of reliable service is negated by the benefits afforded to both carriers by having the neutral Coastal Zone transitional area. Besides having the valuable quality of simplicity, using the land formula in conjunction with the neutral Coastal Zone would have the following benefits: 1) Land carriers would be allowed sufficient signal to adequately serve their subscribers; 2) the Land carrier would not suffer subscriber capture on the shoreline; 3) the Gulf carrier would have a substantially higher (up to 23 dB) signal level at the shoreline than currently permitted which would afford Gulf carriers the opportunity to serve their subscribers on most inland waterways; 4) Gulf carriers would have a high capture ratio at the Exclusive Zone border and in a significant portion of the Coastal Zone; and 5) Gulf carriers would have the flexibility to move among oil platforms.

Appendix A

Detailed Analysis of Required Signal Levels

A-1 Purpose

The purpose of this analysis is to compare the signal levels required for good cellular service to the level that can be expected based on the Land Service Area Boundary definition in order to clarify the deficiencies in service faced by land carriers under the current rules. The old 39 dBu Carey cellular service definition is included because its method provides the under laying basis for both land and Gulf SAB's. Analysis of the Gulf SAB was also included for comparison.

A-2. Values in Table A-1 - Required Signal Level Comparison

Radio propagation over land is an extremely complicated subject on which great effort has been made to reduce complicated probabilistic variables to a few simple fade margins, such as those presented in the Table A-1. The problem for an engineer is not so much justifying all the margins that could contribute to attenuation on a given path, but rather, to reasonably account for mechanisms affecting coverage reliability based on experience and prior science. Therefore, while it is necessary to develop a reasonable individual breakdown of losses and gains to facilitate understanding of what factors are not accounted for by the existing SAB definition, it is equally important to note that the values for Required Signal Level for 50% Reliability will be recognized as approximately those used by cellular engineers across the country. They pass the "Sanity test."

A-2.1 The 39 dBu Carey

The 39 dBu Carey is a straightforward breakdown of factors described in the Carey Report.[8] Since the 39 dBu contour was specified at 455 MHz and then later applied to cellular, the 39 dBu field strength figure was converted to power at the receiver in dBm at a frequency of 860 MHz for comparison to the other columns. In particular, note that Carey specified a 14 dB margin to produce 90% reliability within the contour based on the effects of terrain variation alone; i.e. variations of +/- 50 meters compared to the average terrain on a radial. The only other margin is 5 dB for ambient noise in a suburban environment.

A-2.2 The 32 dBu Land SAB

The change from a 39 dBu SAB definition for cellular was implemented in the Unserved Area Rulemaking Second Report and Order[9]. The formula contained in 47 CFR 22.903(a)(1) was actually adopted instead of field strength, but the Commission acknowledged 32 dBu as the basis for the formula in Second Report. There is not formal breakdown of factors in the record, however, the following approach is consistent with Carey and the development of the Gulf formula, which are in the record.

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[8] R. B. Carey, "Technical Factors Affecting the Assignment of Facilities in the Domestic Public Land Mobile radio Service," Report No. R-6406, Federal Communications Commission, Washington, D.C., 24 June 1964.

[9] CC Docket No. 90-6, Second Report and Order, 7 FCC Rcd 2449 (1992) at paragraph 9.

Receiver (RX) Thermal Noise Threshold is the minimum limit at which a signal is distinguishable from noise and is defined by[10]:

Thermal Noise Threshold dBm = -174 dBm +10 log (ENBW) + (NF)

where ENBW = effective noise bandwidth which is approximately 30 kHz

NF = receiver noise figure and will be assumed as 9[11]

and the standard temperature of 290° Kelvin is used

Which yields a RX Thermal Noise Threshold of –120.2 dBm. This figure is used for all the additional cases.

The Margin for Acceptable Audio is assumed to be 10 dB for an audio quality of 12 dB SINAD, consistent with the Carey process. 12 dB SINAD represents poor, but usable audio quality.[12]

I believe that a margin for ambient noise was intentionally omitted to represent a rural environment, in keeping with the Carey procedure and the focus of the Unserved Area proceeding on Rural Service Areas.

This leaves only 9.4 dB left compared to the –101.8 dBm equivalent of 32 dBu, to account for Terrain variation, which the Carey process uses to account for the difference between average terrain and actual terrain along a path to produce 90% reliability.

A-2.3 The 28 dBu Gulf SAB

The Gulf SAB was adopted by the Commission based on the results of an engineering study submitted by a Gulf carrier[13]. The values in Table A1 are directly from the Dennis Report in those Comments[14].

Although individual items are questionable, such as the assumption of a 4 dB noise figure, the overall formula ensures reliable service to Gulf carriers by taking into account fade mechanisms not included in the land SAB formula. Since propagation over water has much less variability than over land, the formula can actually serve as a useful prediction tool.

A key difference between land and Gulf subscriber units is addressed in this report. The typical Gulf subscriber unit is 3 watt mobile with a 3 dB gain antenna mounted at 9.1 meters (30 feet).

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[10] TIA/EIA TSB88, p 9, Wireless Communications Systems – Performance in Noise and Interference Limited Situations – Recommended Methods for Technology-Independent Modeling, Simulation, and Verification, Telecommunications Industry Association, (1998).

[11] TSB 88, page 21. GTE has also performed internal testing to support a 9 dB noise figure in portable radios.

[12] TSB 88, page 89.

[13] CC Docket 90-6, Third Report and Order, 7 FCC Rcd 7184 (1992) at paragraph 6.

[14] Comments of Petroleum Communications, Inc., Technical Exhibit C (Dennis Report), filed January 16, 1992 in regard to FCC 91-113, Further Notice of Proposed Rulemaking.

The height difference alone gives the Gulf subscribers about 9 dB more range out of their systems.

A-2.4 Reliable Mobile Coverage

This calculation shows the signal level required to produce reliable coverage to permanently installed mobile units in a land environment. The RX Thermal Noise Threshold is the same as used for my interpretation the 32 dBu Carey contour, above.

The single most important difference in my mobile calculations is the use an 18 dB signal to noise (S/N) margin for Acceptable Audio. This margin is stipulated by Bell Labs[15] and is fundamental to cellular design because it provides good to excellent audio when conditions are favorable, and provides a flexible fade margin of about 8 dB of usable audio under unfavorable conditions, most especially multipath fading. In combination with diversity-receive on the uplink, it eliminates the need to include a separate multipath fade margin[16]. Because the downlink considered here does not have diversity reception, 3 dB is used in my calculations for the Multipath Fade Margin for Mobiles and Portables in Car instead of the 10 dB margin typically used in the industry[17]. I believe that use of the 18 dB S/N margin also reduces the necessity to include a separate margin for ambient noise in the general suburban case, and have therefore left that out of my calculations.

RX Antenna Gain is assumed as –1.0 dBd, representing a typical car mounted 3/8 • dipole with a 0.8 dB line loss.

Seasonal Margin (also known as lognormal fading) is small in relation to other margins required and varies with region. For most areas bordering the Gulf, I believe seasonal variations are adequately considered in the other margins and have omitted it.

Local Clutter Loss is attenuation due to shadowing and attenuation from buildings or foliage in the vicinity of the receiver and values from 0 dB in open land to 15 dB in urban areas.[18] A value of 5 dB is assumed to represent the general case of a mixed open/suburban environment.

A-2.5 Reliable Portable on Street Coverage

Coverage to portable (handheld) units outdoors uses the same factors as mobile coverage with the exception of an antenna gain and Rayleigh fading. The Antenna Gain value of –8.6 is based on published testing of the effect of body blockage on a quarter-wave dipole[19]. Rayleigh fading is related to the speed of the receiver and is therefore not applicable to a pedestrian unit.

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[15] V.H. MacDonald, The Cellular Concept page 29, The Bell System Technical Journal, January, 1979.

[16] G. A. Arrendondo, et al, Voice and Data Transmission, pages 98-110, The Bell System Technical Journal, January, 1979.

[17] W. C. Jakes, ed. Microwave Mobile Communications, page 19.

[18] TSB 88, page 45 and 98.

[19] C. Hill & T. Kneisel, Portable Radio Antenna Performance in the 150, 450, 800, and 900 MHz Bands "Outside" and In-Vehicle, page 754, IEEE Transactions on Vehicular Technology, Vol. 40, No. 4, November 1991.

A-2.6 Reliable Portable-In-Car Coverage

Coverage to portable (handheld) units outdoors uses the same factors as mobile coverage with the exception of an antenna gain. The Antenna Gain value of –12.2 is based on published testing of the effect of combined body blockage and vehicle blockage on a quarter-wave dipole[20]

A-2.7 Reliable Portable In-Building Coverage

Coverage requirements to portable units in buildings is identical to Portable on Street coverage, above, except for the addition of a Building Loss. Building penetration loss at cellular frequencies range from 7 dB for wooden houses up to 30 dB or more for large buildings and a typical loss is 13 dB[21].

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[20] Ibid.

[21] T. Rappaport, Wireless Communications, page 132, (1996).

Service Factor	39 dBu Carey	32 dBu Land SAB	28 dBu Gulf SAB	Reliable Mobile	Reliable Portable on Street	Reliable Portable in Car	Reliable Portable in Building
a) RX Thermal Noise Threshold (KTB+NF)	20 dBu	-120.2 dBm	-125.2 dBm	-120.2 dBm	-120.2 dBm	-120.2 dBm	-120.2 dBm
b) Ambient Noise	5 dB (suburban)	0 dB (rural)	0 dB (ocean)	Considered in c)	Considered in c)	Considered in c)	Considered in c)
c) Margin for Acceptable Audio	Not stated, incl. above, based on 12 dB SINAD	10 dB, based on 12 dB SINAD	10 dB, based on 12 dB SINAD	18 dB, based on Bell standard CM4	18 dB, based on Bell standard CM4	18 dB, based on Bell standard CM4	18 dB, based on Bell standard CM4
d) RX Effective Sensitivity (a+b+c)	25 dBu (-103.2 dBm @ 455 MHz)	-110.2 dBm	-115.2 dBm	-102.2 dBm	-102.2 dBm	-102.2 dBm	-102.2 dBm
e) RX Antenna Gain	0 dBd	0 dBd	+0.6 dBd	-1.0 dBd	-8.6 dBd	-12.2 dBd	-8.6 dBd
f) RX Ant Blockage (Body, mast or car)	0 dB	0 dB	4 dB	0 dB	Included above	Included above	Included above
g) Seasonal Margin (lognormal fade)	omitted	omitted	3 dB	Variable, omitted	Variable, omitted	Variable, omitted	Variable, omitted
h) Multipath Margin (Rayleigh fading)	omitted	omitted	3 dB	3 dB	Considered in other margins	3 dB	Considered in other margins
i) Building Loss	N/A (mobile)	N/A (mobile)	N/A (mobile)	N/A (mobile)	N/A	N/A (mobile)	13 dB
j) Local Clutter Loss	omitted	omitted	N/A (ocean)	5 dB	5 dB	5 dB	5 dB
k) Required RX Signal Level for 50% Reliability For Comparison (d-e+f+g+h+I+j)	25 dBu (-103.2 dBm @ 455 MHz)	-110.2 dBm	-105.8	-97.2 dBm	-88.6 dBm	-82 dBm	-75.6 dBm
l) Carey 90% Contour Reliability Margin for Terrain Variation	14 dB	9.4 dB	0 dB (not required for ocean)	N/A	N/A	N/A	N/A
m) Carey contour level (k-l)	39 dBu to a 1.8 m. RX height	32 dBu to a 1.8 m. RX height = -101.8 dBm	-105.8 dBm = 28 dBu to a 9.1 m. RX ht.	N/A	N/A	N/A	N/A
Margin over service quality provided by 32 dBu SAB ($k_{32\,dBu}-k_i$)	+7.0 dB	0 dB	+4.4 dB	-13.0 dB	-21.6 dB	-28.2 dB	- 34.6 dB

Table A-1 – Required Signal Level Comparison

Appendix B

Propagation Plots

B-1 Propagation Plot Methodology

The attached coverage studies use the definitions of reliable service developed in Appendix A and specified in Table A-1, line (k). They are:

Gulf Subscriber: <= -105.8 dBm at a receive antenna height of 9.1 meters

Land Subscriber Units, all at a receive antenna height of 1.8 meters;
Portable in Building • -75.6 dBm
Portable in Car • -82.0 dBm
Portable on Street • -88.6 dBm
Mobile • -97.2 dBm
No Reliable Coverage • -97.2 dBm

Both environments were calculated for a Location Variability of 90%, which is the point-to-point model equivalent of the Terrain Variation Margin used in the Carey.

The propagation modeling software is Signal™ Version 5 form EDX Engineering in Eugene, Oregon.

The propagation model used for land calculations is the Hata-Extended/Epstein-Peterson Diffraction[22]. This is probably the most generally used model in the industry for cellular coverage studies on land.

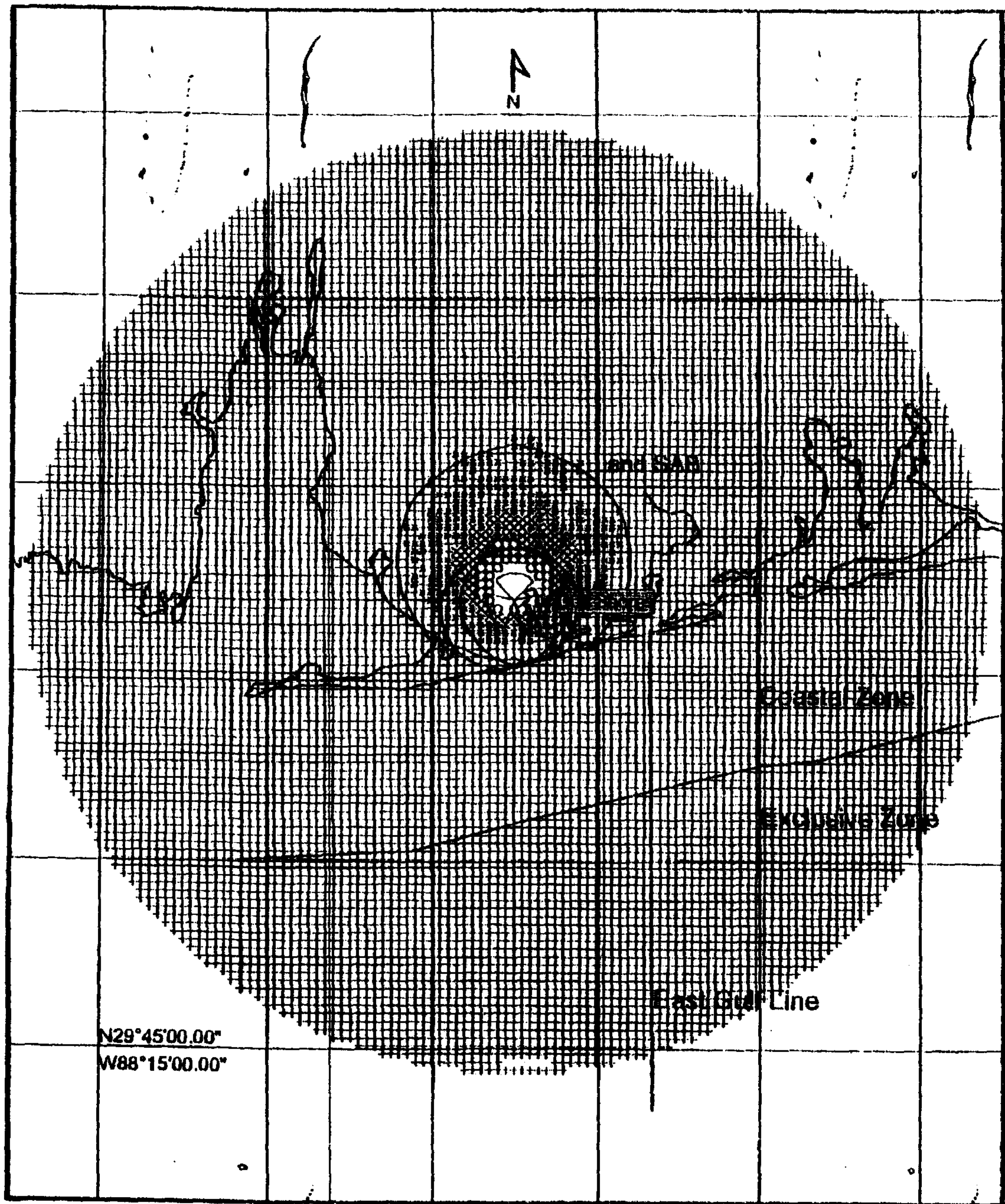
Propagation prediction over water requires a model with a smooth-earth mode, so Longley-Rice V1.2.2[23] is used. This model is also called the ITS Irregular Terrain model.

SAB contours were developed in accordance with 47 CFR § 22.911(a)(1) and (a)(2). Signal™ doesn't support the Gulf SAB, so it had to be calculated manually.

Note that each study is only valid for the conditions specified, i.e., the portion of an over-water study that extends onto the shore does not represent any defined service and should be ignored.

[22] TSB-88, page 29.

[23] G.A. Hufford, A.G. Longley and W.A. Kissick, "A Guide to the Use of the ITS Irregular Terrain Model in the Area Prediction Mode", NTIA Report 82-100. (1982).



SIGNAL™: Alltel Plot 1.map

Prop. model: Hata-Extended/E-P diff.
Time: 50.0% Loc.: 90.0%
Prediction Confidence Margin: 0.0dB
Climate: Maritime Temperate (Land)
Land use (clutter): none
Atmospheric Abs.: none
K Factor: 1.333
RX Antenna - Type: OMNI
Height: 1.8 m AGL Gain: 0.00 dBd

Sites

Site: Gulf Shores
N30°20'51.90" W87°37'43.30" 8.8 m
JCGT05AP Tx.Ht.AGL: 91.4 m ERPd: 18.33 dBW
Grp: 1 DA-VV/0.0° 870.0000 MHz
JCGT05BP Tx.Ht.AGL: 91.4 m ERPd: 0.00 dBW
Grp: 1 DA-VV/120.0° 870.0000 MHz
JCGT05CP Tx.Ht.AGL: 91.4 m ERPd: 0.00 dBW
Grp: 1 DA-VV/240.0° 870.0000 MHz

Reference Grid (spacing: 15')

Received power at remote

> -75.6 dBmW
-82.0 to -75.6 dBmW
-88.6 to -82.0 dBmW
-97.2 to -88.6 dBmW
< -97.2 dBmW

Display threshold level: -200.0 dBmW

Coast
Exclusive Zone
East Gulf Line
Gulf Shores Existing 32 dBu SAB

Notes

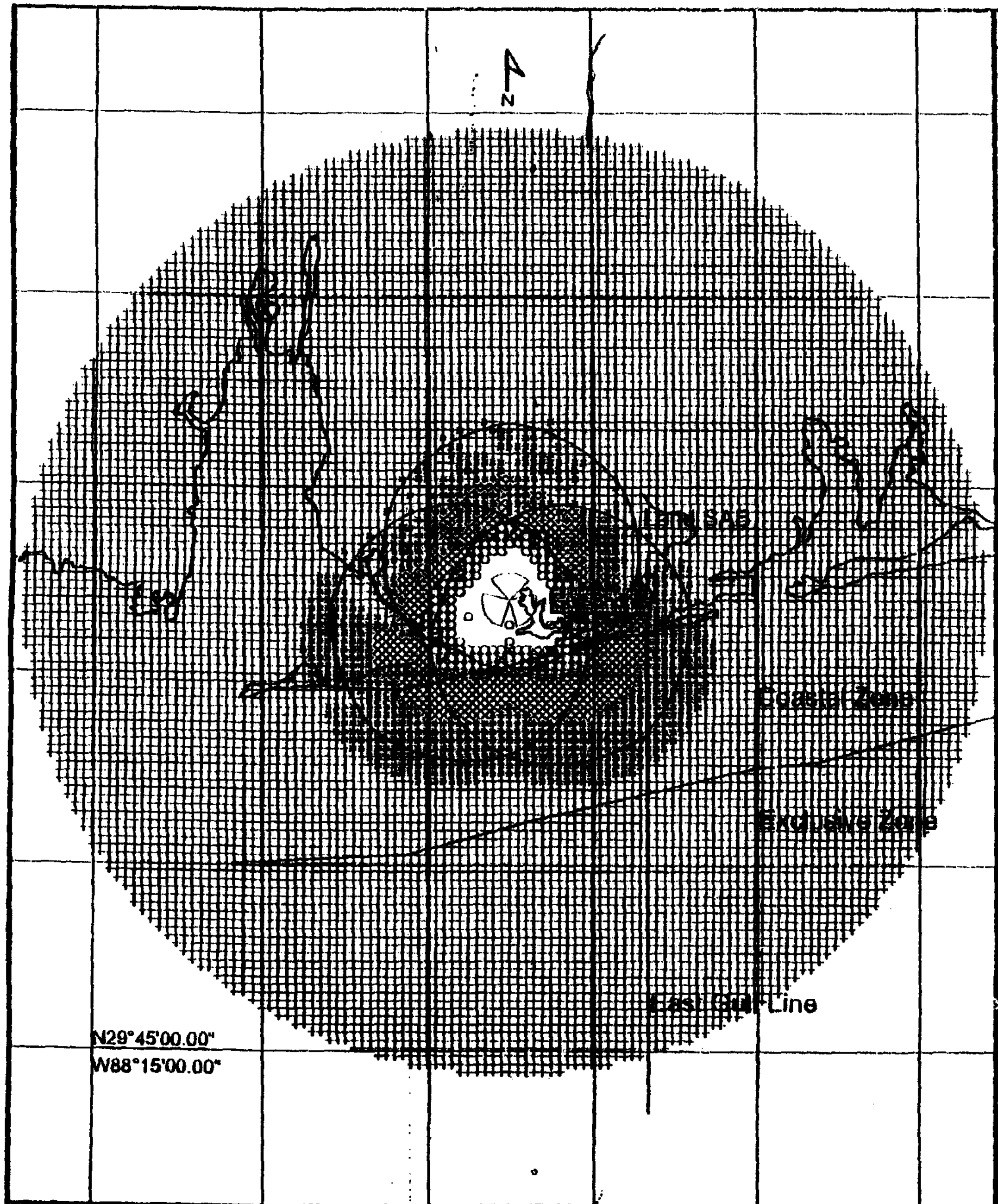
A- ALP 92-14, 0° DT, 68 w.
B- ALP 92-14, 6° DT, 1 w.
C- ALP 92-14, 3° DT, 1 w.

KILOMETERS
-25 0 25

Alltel Gulf Proposal

Gulf Shores Existing Land Coverage

Plot 1 Mobile, AL



SIGNAL™: Alltel Plot 2.map

Prop. model: Hata-Extended/EP diff.
Time: 50.0% Loc.: 90.0%
Prediction Confidence Margin: 0.0dB
Climate: Maritime Temperate (Land)
Land use (clutter): none
Atmospheric Abs.: none
K Factor: 1.333
RX Antenna - Type: OMNI
Height: 1.8 m AGL Gain: 0.00 dBd

Sites

Site: Gulf Shores
N30°20'51.90" W87°37'43.30" 8.8 m
JCGT05AP Tx.Ht.AGL: 91.4 m ERPd: 21.76 dBW
Grp: 1 DA-VV/0.0° 870.0000 MHz
JCGT05BP Tx.Ht.AGL: 91.4 m ERPd: 21.76 dBW
Grp: 1 DA-VV/120.0° 870.0000 MHz
JCGT05CP Tx.Ht.AGL: 91.4 m ERPd: 21.76 dBW
Grp: 1 DA-VV/240.0° 870.0000 MHz

Reference Grid (spacing: 15')

Received power at remote

> -75.6 dBmW
-82.0 to -75.6 dBmW
-88.6 to -82.0 dBmW
-97.2 to -88.6 dBmW
< -97.2 dBmW

Display threshold level: -200.0 dBmW

Coast
Exclusive Zone
East Gulf Line
Gulf Shores Proposed 32 dBu SAB

Notes

A- ALP 92-14, 0° DT, 150 w.
B- ALP 92-14, 0° DT, 150 w.
C- ALP 92-14, 0° DT, 150 w.

KILOMETERS

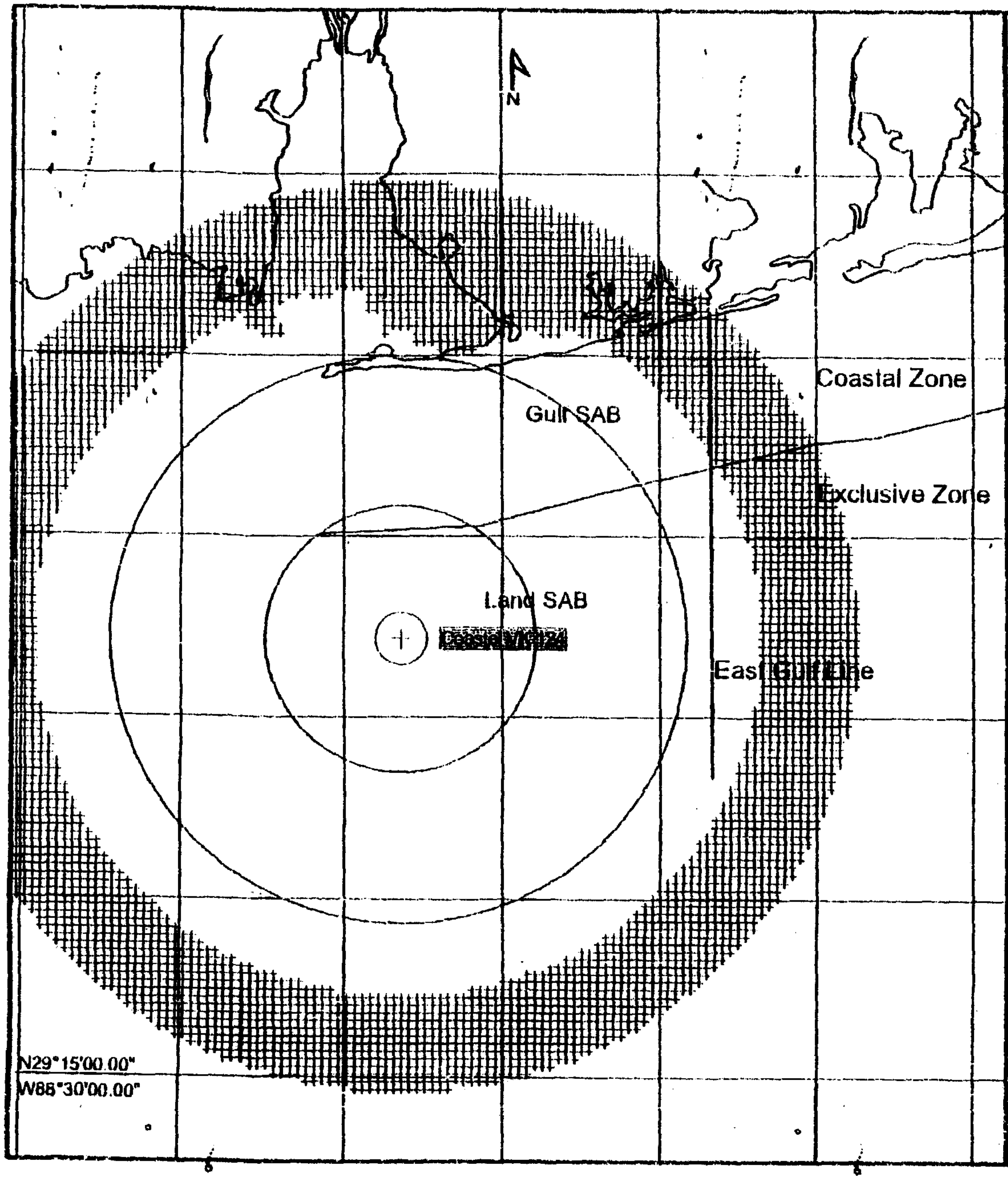
-25 0 25

Alltel Gulf Proposal

Gulf Shores Proposed Land Coverage/SAB

Plot 2

Mobile, AL



SIGNAL™: Alltel Plot 3.map

Prop. model: Longley-Rice v1.2.2
Time: 50.0% Loc.: 90.0%
Prediction Confidence Margin: 0.0dB
Climate: Maritime Temperate (Land)
Land use (clutter): none
Atmospheric Abs.: none
K Factor: 1.333
RX Antenna - Type: OMNI
Height: 9.1 m AGL Gain: 0.00 dBd

Sites

Site: Coastel VK 124
N29°51'29.00" W87°54'33.00" 0.0 m
JCGTVKP Tx.Ht.AGL: 32.9 m ERPd: 23.00 dBW
Grp: 1 Omni-VV/0.0° 870.0000 MHz

Reference Grid (spacing: 15')

Received power at remote
> -105.8 dBmW
< -105.8 dBmW
Display threshold level: -200.0 dBmW

Coast
Exclusive Zone
East Gulf Line
Coastel VK124 32 dBu SAB
Coastel VK124 28 dBu SAB

Notes

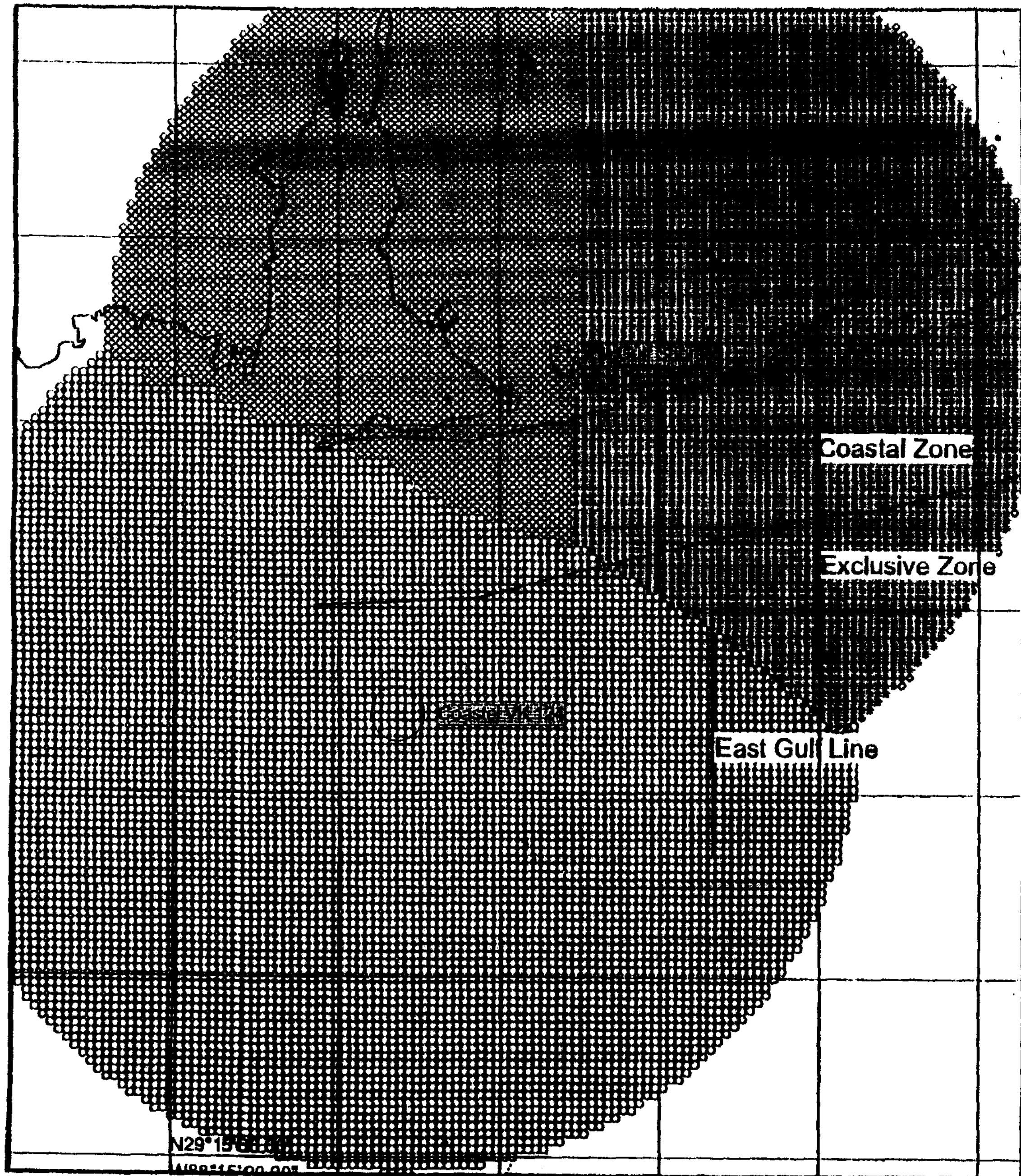
Coastel VK124 changed from existing 100 W.
to modified 200 W.
Coverage based on Gulf subscriber requirements
and 9.1 meter RX antenna height

KILOMETERS
-25 0 25

Alltel Gulf Proposal

Modified Coastel VK124 Gulf Coverage/SAB

Plot 3 Mobile, AL



SIGNAL™: Alltel Plot 4.map

Prop. model: Longley-Rice v1.2.2
Time: 50.0% Loc.: 90.0%
Prediction Confidence Margin: 0.0dB
Climate: Maritime Temperate (Land)
Land use (clutter): none
Atmospheric Abs.: none
K Factor: 1.333
RX Antenna - Type: OMNI
Height: 9.1 m AGL Gain: 0.00 dBd

Sites

Site: Coastel VK 124
N29°51'29.00" W87°54'33.00" 0.0 m
JCGTVKP Tx.Ht.AGL: 32.9 m ERPd: 23.00 dBW
Grp: 1 Omni-VV/0.0° 870.0000 MHz

Site: Gulf Shores
N30°20'51.90" W87°37'43.30" 8.8 m
JCGT05BP Tx.Ht.AGL: 91.4 m ERPd: 21.76 dBW
Grp: 1 DA-VV/120.0° 870.0000 MHz
JCGT05CP Tx.Ht.AGL: 91.4 m ERPd: 21.76 dBW
Grp: 1 DA-VV/240.0° 870.0000 MHz

Reference Grid (spacing: 15')
Strongest (most likely) server
Display threshold level: -200.0 dBmW
JCGT05CP
JCGT05BP
JCGTVKP
Coast
Exclusive Zone
East Gulf Line

Notes

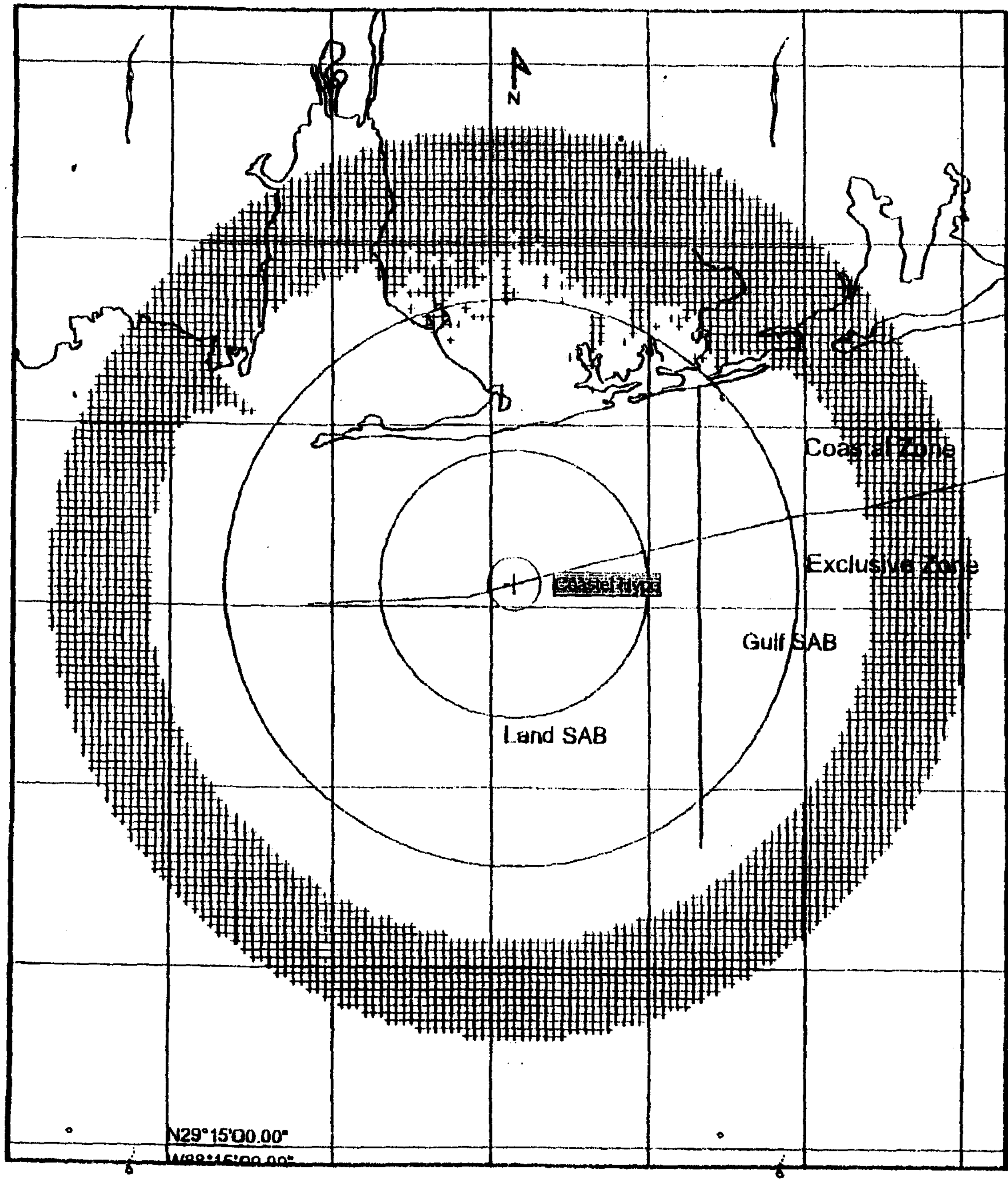
Coastel VK124 modified to 200 W. for existing 100 W. Proposed Gulf Shores, Gulf sectors only
B- ALP 92-14, 0° DT, 150 W.
C- ALP 92-14, 0° DT, 150 W.
Coverage based on Gulf subscriber requirements and 9.1 meter RX antenna height

KILOMETERS
-25 0 25

Alltel Gulf Proposal

Coastel Modified vs Proposed Gulf Shore

Plot 4 Mobile, AL



SIGNAL™: Alltel Plot 5.map

Prop. model: Longley-Rice v1.2.2
Time: 50.0% Loc.: 90.0%
Prediction Confidence Margin: 0.0dB
Climate: Maritime Temperate (Land)
Land use (clutter): none
Atmospheric Abs.: none
K Factor: 1.333
RX Antenna - Type: OMNI
Height: 9.1 m AGL Gain: 0.00 dBd

Sites

Site: Coastel Hypo
N30°01'54.00" W87°42'48.00" 0.0 m
JCGTHYPO Tx.Ht.AGL: 32.9 m ERPd: 23.00 dBW
Grp: 1 Omni-VV/0.0° 870.0000 MHz

Reference Grid (spacing: 15')

Received power at remote
> -105.8 dBmW
< -105.8 dBmW
Display threshold level: -200.0 dBmW

Coast
Exclusive Zone
East Gulf Line
Coastel Hypothetical 32 dBu SAB
Coastel Hypothetical 28 dBu SAB

Notes

Coastel Hypothetical site based on VK124
at 200 W.
Coverage based on Gulf subscriber requirements
and 9.1 meter RX antenna height

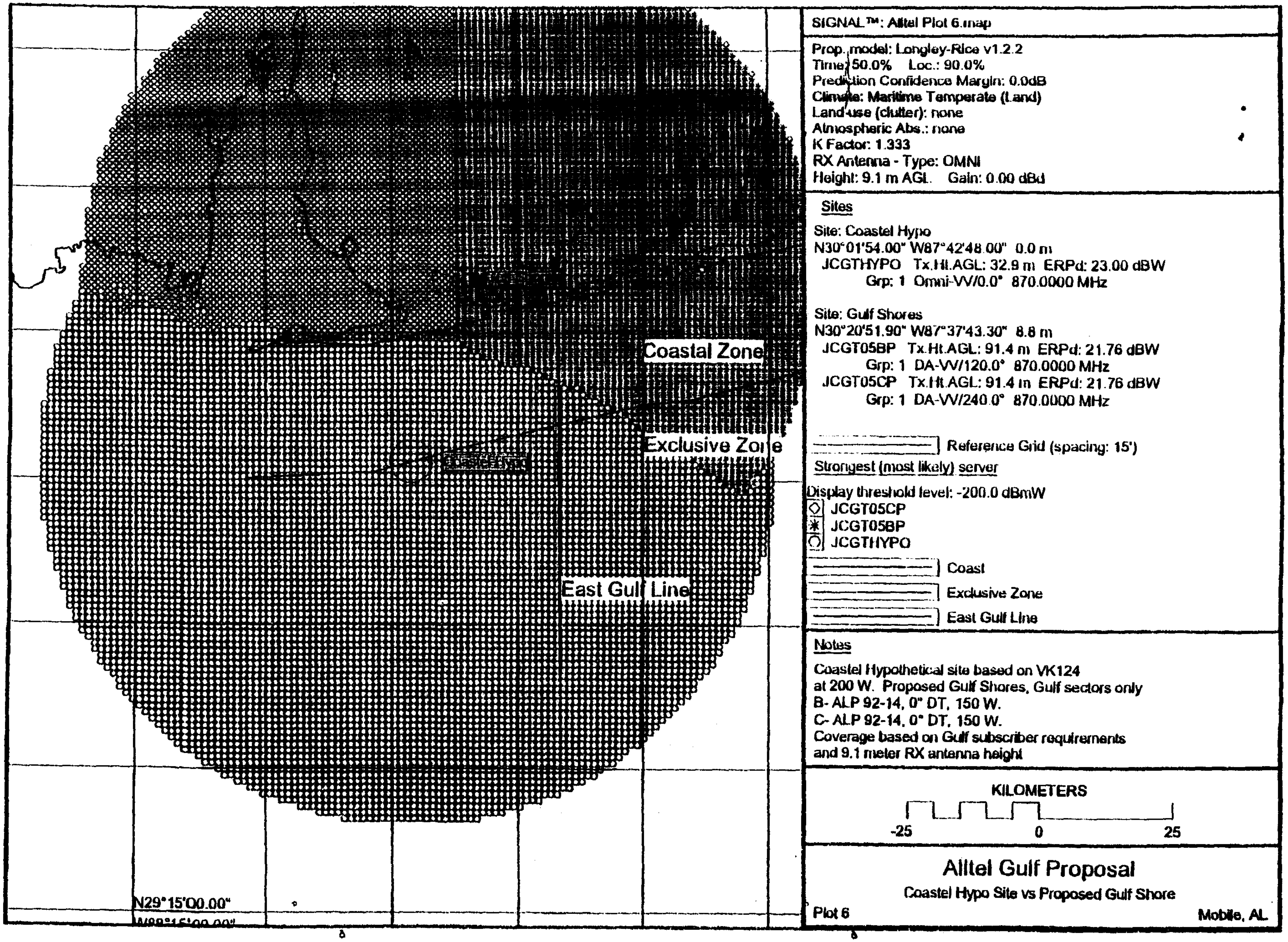
KILOMETERS
-25 0 25

Alltel Gulf Proposal

Coastel Hypo Site Gulf Coverage/SAB's

Plot 5

Mobile, AL


SIGNAL™: Alltel Plot 6.map
Prop. model: Longley-Rice v1.2.2
Time: 50.0% Loc.: 90.0%
Prediction Confidence Margin: 0.0dB
Climate: Maritime Temperate (Land)
Land use (clutter): none
Atmospheric Abs.: none
K Factor: 1.333
RX Antenna - Type: OMNI
Height: 9.1 m AGL. Gain: 0.00 dBd
Sites
Site: Coastel Hypo
N30°01'54.00" W87°42'48.00" 0.0 m
JCGTHYPO Tx.Ht.AGL: 32.9 m ERPd: 23.00 dBW
Grp: 1 Omni-VV/0.0° 870.0000 MHz
Site: Gulf Shores
N30°20'51.90" W87°37'43.30" 8.8 m
JCGT05BP Tx.Ht.AGL: 91.4 m ERPd: 21.76 dBW
Grp: 1 DA-VV/120.0° 870.0000 MHz
JCGT05CP Tx.Ht.AGL: 91.4 m ERPd: 21.76 dBW
Grp: 1 DA-VV/240.0° 870.0000 MHz
Reference Grid (spacing: 15')
Strongest (most likely) server
Display threshold level: -200.0 dBmW
JCGT05CP
JCGT05BP
JCGTHYPO
Coast
Exclusive Zone
East Gulf Line
Notes
Coastel Hypothetical site based on VK124
at 200 W. Proposed Gulf Shores, Gulf sectors only
B- ALP 92-14, 0° DT, 150 W.
C- ALP 92-14, 0° DT, 150 W.
Coverage based on Gulf subscriber requirements
and 9.1 meter RX antenna height
KILOMETERS
-25
0
25
Alltel Gulf Proposal
Coastel Hypo Site vs Proposed Gulf Shore
Plot 6
Mobile, AL
Coastal Zone
Exclusive Zone
East Gulf Line
N29°15'00.00"

TROTT
COMMUNICATIONS GROUP

Declaration of James E. Calkins

I ~~am a~~ Senior RF Systems Engineer for Trott Communications Group, Inc. ("Trott"), an independent engineering consulting company founded in 1978 and located in Irving, Texas.

I have been involved in the technical and regulatory aspects of cellular telephone system design and licensing for over 10 years and they have been my primary responsibility for over 6 years. During this time I have prepared hundreds of cellular coverage studies, SAB/CGSA determinations, and technical exhibits to FCC filings. I also have extensive experience in the design and licensing of other land mobile and commercial wireless services.

I, James E. Calkins, declare under penalty of perjury that:

I prepared the attached Technical Report on Alltel's Proposal for the Gulf Rulemaking, and the statements contained above and therein are true to the best of my knowledge and belief.

James E. Calkins

James E. Calkins

July 3, 2000

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